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(54) CATALYTIC METAL COLLOID

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a catalyst having a high dispersibility and a high NOx-occluding capacity when an alkali metal, an alkali earth metal or a rare earth metal is carried on a catalytist carrier.

SOLUTION: This catalytic metal colloid is used when a process A for carrying an alkali metal, an alkali earth metal or a rare earth metal, and a process B for carrying another chelated catalytic metal are executed as separate processes. When one kind or at least two kinds of catalytic metals to be used in the process B are made colloidal by chelating bond in this case, a certain specific polymer chelating agent is used.

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1]In a catalyst support process of an alkaline metal, alkaline-earth metals, or a rare earth support type catalyst, A process of supporting one sort of an element belonging to either an alkaline metal, alkaline-earth metals or rare earth, or two sorts or more, It is catalyst metallic colloid used when performing B process of supporting catalyst metal which others made chelating, as a separate process, To a high polymer chelating agent used when carrying out the chelate bond of one sort or two sorts or more of catalyst metal used in B process and making it colloid-ize. Polyacrylic acid, polyallylamine, polymethacrylic acid, polyvinyl amine, Poly(N,N-dicarboxymethyl) allylamine, polyvinyl imidazole, Polyvinyl PIIRAZORU, polyacrylamide, polyvinyl METOKISAZORIDON, Polyamide of ethylene-diamine-tetraacetic acid and ethylenediamine, polyamide of an acid anhydride of 1,2-cyclohexanediamine tetraacetic acid, and 1,2-diaminocyclohexane, Polyamide of 1,2-cyclohexanediamine tetraacetic acid and 1,2-diaminocyclohexane, polyamide of 1,2-cyclohexanediamine tetraacetic acid and ethylenediamine, a copolymer of vinyl acetate and methacrylic acid, And polymers chelate catalyst metallic colloid using either [of a copolymer of itaconic acid and methacrylic acid] any one sort or two sorts or more.
[Claim 2]The polymers chelate catalyst metallic colloid according to claim 1 being the range of weight ratio (M/P) =1 of catalyst metal (M) and a chelating agent (P) / 4 - 1/0.2.
[Claim 3]The polymers chelate catalyst metallic colloid according to claim 1 or 2, wherein catalyst metal used in B process is any one sort of platinum, rhodium, iridium, a ruthenium, palladium, silver, gold, osmium, and the rhenium, or two sorts or more.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to catalyst metallic colloid which is basic materials of the outstanding catalyst for exhaust gas purification. It is useful to use for manufacture of the catalyst for purification useful to especially the exhaust gas for cars.
[0002]
[Description of the Prior Art]The catalyst for exhaust gas purification, wherein the conventional catalyst for lean burn automobile exhaust purification consists of the barium oxide, the lanthanum oxide, and platinum which the carrier which is a porous body, and the carrier concerned were made to support so that JP,5-261287,A may see is known.
[0003]How to make this catalyst immersed the carrier which carried out the coat of the alumina to the mixed solution of the solution of a dinitrodiammine platinum nitric acid solution, barium acetate, or a barium nitrate, and lanthanum nitrate solution, calcinated after desiccation and was manufacturing.
[0004]
[Problem(s) to be Solved by the Invention]However, the conventional catalyst for lean burn automobile exhaust purification was weak to heat resistance, under continuous hot environments, sintering (condensation) of the platinum was carried out and the phenomenon in which an exhaust gas purifying rate, especially a NOX occlusion amount fell and carried out had generated it.
[0005]About sintering of this platinum, this artificer has advocated solving according to the catalyst which used polyvinyl-pyrrolidone (PVP is called.)-platinum / rhodium bimetal colloid.
[0006]However, when an alkaline metal, alkaline-earth metals, or a rare earth metal, for example, barium, was supported for the catalyst using PVP-platinum / rhodium compound colloid and NO_X occlusion amount was investigated, it turned out that performance as prediction of the beginning [occlusion amount / NO_X] cannot be demonstrated.
[0007]As a result of examining in detail where this cause is, it became clear that, as for this invention persons, there was a problem in the gestalt at the time of a catalyst being supported.

That is, it came to obtain the conclusion that there is a problem in the dispersibility of barium at the time of supporting barium to catalyst support.

[0008]

[Means for Solving the Problem]Then, this invention persons control sintering of platinum by using composite metal colloid, such as platinum-rhodium, And by supporting one sort of an element which belongs near the platinum to either an alkaline metal, alkaline-earth metals or rare earth (an "alkaline metal etc." is called hereafter.), or two sorts or more to high distribution, As catalyst metallic colloid suitable for catalyst manufacture which can acquire a catalyst for emission gas purification for cars which has the conventionally outstanding NO_X occlusion ability, Catalyst metallic colloid used for catalyst metal support of a catalyst for emission gas purification for cars which raised the dispersibility of the following alkaline metals etc. was developed.

[0009]And if catalyst metallic colloid concerning this invention is used, it will become possible not only composite metal colloid but to acquire supported type catalysts, such as an alkaline metal usable as an exhaust gas catalyst for cars, even if it is single metal colloid. A catalyst particle and a catalyst particle condense sintering here, and it means a coarse-grain-ized phenomenon. If a catalyst particle coarse-grain-izes, a fall of a catalytic reaction interfacial area of a catalyst particle and exhaust gas will be caused, and a result to which purification performance of exhaust gas is reduced will be brought.

[0010]In a catalyst support process of an alkaline metal, alkaline-earth metals, or a rare earth support type catalyst in claim 1, A process of supporting one sort of an element belonging to either an alkaline metal, alkaline-earth metals or rare earth, or two sorts or more, It is catalyst metallic colloid used when performing B process of supporting catalyst metal which others made chelating, as a separate process, To a high polymer chelating agent used when carrying out the chelate bond of one sort or two sorts or more of catalyst metal used in B process and making it colloid-ize. Polyacrylic acid, polyallylamine, polymethacrylic acid, polyvinyl amine, Poly(N,N-dicarboxymethyl) allylamine, polyvinyl imidazole, Polyvinyl PIIRAZORU, polyacrylamide, polyvinyl METOKISAZORIDON, Polyamide of ethylene-diamine-tetraacetic acid and ethylenediamine, polyamide of an acid anhydride of 1,2-cyclohexanediamine tetraacetic acid, and 1,2-diaminocyclohexane, Polyamide of 1,2-cyclohexanediamine tetraacetic acid and 1,2-diaminocyclohexane, polyamide of 1,2-cyclohexanediamine tetraacetic acid and ethylenediamine, a copolymer of vinyl acetate and methacrylic acid, And it is considered as polymers chelate catalyst metallic colloid using either [of a copolymer of itaconic acid and methacrylic acid] any one sort or two sorts or more.

[0011]Polymers chelate catalyst metal here is used in a catalyst support process of performing separately support of an alkaline metal to porous bodies, such as alumina, etc., and support with other catalyst elements. Although it has indicated "A process of supporting one sort of an element belonging to either an alkaline metal, alkaline-earth metals or rare earth or two sorts or more, and B process of supporting catalyst metal which others made chelating are performed as a separate process" in claim 1, As for an order of support over a porous body of A process and B process, a problem does not become.

[0012]That is, one sort of an element which supports one sort of metal or a composite metal to a porous body which is a carrier first, and belongs to it after that at either, such as an alkaline metal, or two sorts or more may be supported. On the other hand, order which supports one sort of an element belonging to either, such as an alkaline metal, or two sorts or more to a porous body which is a carrier first, supports a single metal or a composite metal after that to it, and is supported may differ. thus -- if catalyst metallic colloid concerning this invention using a chelating agent mentioned above is used even if it puts in and changes an order of A process of supporting an alkaline metal etc., and B process of supporting a single metal or a composite metal -- the precious metals, an alkaline metal, etc. -- high -- it becomes possible to support with a state [****].

[0013]In a chelating agent here, polyacrylic acid, polyallylamine, Polymethacrylic acid, polyvinyl amine, poly(N,N-dicarboxymethyl) allylamine, Polyvinyl imidazole, polyvinyl PIIRAZORU, polyacrylamide, Polyvinyl METOKISAZORIDON, polyamide of ethylene-diamine-tetraacetic acid and ethylenediamine, Polyamide of an acid anhydride of 1,2-cyclohexanediamine tetraacetic acid, and 1,2-diaminocyclohexane, Polyamide of 1,2-cyclohexanediamine tetraacetic acid and 1,2-diaminocyclohexane, Any one sort of polyamide of 1,2-cyclohexanediamine tetraacetic acid and ethylenediamine, a copolymer of vinyl acetate and methacrylic acid, and the copolymer of itaconic acid and methacrylic acid or two sorts or more shall be used.

[0014]These chelating agents are easy to remove in a calcination process after excelling in the chelation effect and performing catalyst support, and it is very rare to affect catalyst performance. Especially, large one as a merit using these chelating agents has an adsorption rate at the time of supporting chelated catalyst metal to a porous body in a point referred to as becoming very large. An adsorption rate is quick, if catalyst support time can be shortened, production time of a catalyst body can be shortened and a time production cost can be reduced, and it can supply as a cheaper product.

[0015]It is as having indicated the amount of chelating agent used at this time to claim 2. That is, it is the range of weight ratio (M/P) =1 of catalyst metal (M) and a chelating agent (P) / 4 - 1/0.2. A reason defined as such a range is mentioned later.

[0016]And it can use for catalyst metal, combining selectively any one sort of platinum, rhodium, iridium, a ruthenium, palladium, silver, gold, osmium, and the rhenium, or two sorts or more so that it may indicate to claim 3. When using combining two or more sorts selectively, particles of at least one sort of catalyst metal cover the circumference of other metallic colloid particles, become what plays a role of protective colloid, and can maintain high catalyst performance over a long period of time. For example, if it is the combination of platinum and rhodium, rhodium colloid will cover the surface of platinum colloid and a role which protects platinum colloid will be played.

[0017]Some compounds used as a supply source of above-mentioned catalyst metal are various. In the case of single catalyst metallic colloid, it is sufficient if it is used [for the purpose of a compound containing one sort of catalyst metal / suitably] selectively. However, for example, many kinds of optimal combination exists as it is preferred as a platinum compound

to use dinitrodiammine platinum and it is preferred to use nitric acid rhodium as a rhodium compound, in order to obtain platinum-rhodium composite metal colloid. Optimal combination should be defined in consideration of the various characteristics of whether on the occasion of actual use, high catalyst performance is securable in the ability to support [whether it excels in the long-term stability of quality of colloid, and] easily. Anyway, in consideration of affinity with a chelating agent to be used, a suitable compound containing above-mentioned catalyst metal can be used selectively suitably.

[0018]Alumina, silica, a silica alumina, zeolite, mordenite, a titania, Seria, and zirconia can be used for a porous body here. It is useful to use alumina, if an economical field is taken into consideration, and alternative use doubled with the purpose of using a final catalyst, such as using mordenite with width of selection if there is the necessity of taking a diameter of porosity into consideration, is possible.

[0019]A support method is performed by carrying out predetermined time churning and making a porous body of the specified quantity, and polymers chelate catalyst metallic colloid adsorb in solution. Support processing of an alkaline metal etc. is performed as a last process or a back process of this polymers chelate catalyst metal support.

[0020]Compounds, such as an alkaline metal containing a specified element, are used for support of an alkaline metal etc. Especially, barium compounds suitable for using, when supporting barium among alkaline-earth metals are barium acetate, EDTA barium, CyDTA barium, barium nitrate, and barium tetranitroplatinate and barium chloroplatinate. It becomes possible to make it join together as particles of barium with a high degree of dispersion distributed minutely and uniformly by using these barium compounds.

[0021]After A process and B process which are support processes of a catalyst element are completed, after that, moisture is made to evaporate to dryness, a drying process is performed, it calcinates with prescribed temperature for several hours, and manufacture of a polymers chelate metal catalyst is completed. This polymers chelate metal catalyst becomes possible [a degree of dispersion of an alkaline metal etc. being high, stopping advance of sintering of catalyst metal, and maintaining outstanding NO_X occlusion ability].

[0022]As mentioned above, stable occlusion of NO_X which was not able to be obtained with the conventional catalyst of an exhaust gas cleaning catalyst of a car adjusted using catalyst metallic colloid concerning this invention becomes possible, and it becomes realizable [an outstanding LEV car].

[0023]Catalyst metallic colloid described above is the directions for use in a method of supporting a catalyst directly to a porous body which is a fine grain, i.e., a granular material. However, it is useful to carry out the coat of the surface of a monolith which is a component of a catalyst body by a porous body which is a fine grain beforehand, and to use after that polymers chelate metal catalyst colloid applied to this invention in a manufacturing process of a supported type catalyst, such as an alkaline metal which supports catalyst metal to a porous body. Material used for manufacture of winding-up catalysts, such as metal waveform foil and metal spacer foil, and a square-shaped lamination catalyst with a monolith at the above and

the following, It uses as a concept containing all the members that constitute catalyst bodies, such as a component of a ceramic honeycomb, and a ceramic honeycomb which carried out integral moulding.

[0024]It becomes possible to raise the adsorptivity of catalyst metal at the time of supporting catalyst metal of catalyst metallic colloid concerning this invention. When supporting catalyst metal, it is difficult to once support compared with supporting catalyst metal to a porous body which is a fine grain to a porous body which is the fine grain which carried out the coat to a monolith, and an adsorption rate of catalyst metal gets remarkably bad.

[0025]By using catalyst metal using the chelating agent according to claim 1 as a means to solve this problem, an adsorption rate can be raised and the state where other catalyst metal, such as an alkaline metal, distributed minutely uniformly can be acquired.

[0026]Here, with a porous body which is a fine grain, it is one sort of alumina, silica, a silica alumina, zeolite, mordenite, a titania, Seria, and zirconia, or two sorts or more like the above-mentioned. A coat to a monolith of this porous body immerses a monolith into solution which made a porous body suspended, and a porous body of a multiple-times repetition and the amount of the purposes carries out the coat of the process to dry.

[0027]If catalyst metallic colloid concerning this invention is used, support to a porous body in the state where the coat was carried out to a monolith will become an adsorption rate is quick and possible [shortening substantially time which a support process takes].

[0028]In order to explain this more nearly plainly, when a honeycomb which carried out the coat of the alumina to platinum colloid which is the single catalyst metallic colloid which used polyacrylic acid (PAA is called hereafter.) for a chelating agent is immersed, Adsorption support speed of platinum which is catalyst metal with a case of platinum colloid using a polyvinyl pyrrolidone (PVP is called hereafter.) which is not contained in a compound indicated to claim 1 is measured. A relation of platinum concentration and adsorption (support) time which remained in platinum colloid is shown in drawing 1.

[0029]According to this drawing 1, compared with a case where PVP is used, the amount of remains platinum is decreasing rapidly temporally, and a thing using PAA as a chelating agent is understood that speed in which platinum whose case where PVP is used is a catalyst element carries out adsorption support is very quick. If adsorptivity and stability are taken into consideration, as shown in drawing 1, the range of weight ratio (M/P) =1 of catalyst metal (M) and a chelating agent (P) / 4 - 1/0.2 will serve as the best adsorption rate. Also in this range, the range of weight ratio (M/P) =1 / 3 - 1/1 shows an adsorption rate quick in peak.

[0030]

[Embodiment of the Invention]Hereafter, the embodiment considered to be best [about this invention] is described. About a 1st embodiment, barium is combined using single metal colloid. A 2nd embodiment and a 3rd embodiment combine barium using composite metal colloid.

[0031]A 1st embodiment: Dissolution mixing of the polyacrylic acid 2g of 8.688 g of dinitrodiammine platinum (platinum concentration 4.604%) and the molecular weight 2000 was carried out first at 450 ml of water, 112.5 ml of ethanol was added, and it returned for 5 hours.

Suction filtration of this was carried out, it was condensed, and polymers chelate catalyst metallic colloid was obtained as polyacrylic acid-platinum colloid of 0.5623-% of the weight platinum. The obtained colloid shows the particle diameter of 2 to 4 nm.

[0032]Next, the alumina 4g used as a carrier was added into 40 ml of polyacrylic acid-platinum colloid of the above-mentioned 0.5623-% of the weight platinum, and was agitated for 30 minutes, and platinum support which is B process was performed. As an A process, the barium acetate 3.40g was added, it agitated for 16 hours, and barium which is alkaline-earth metals was combined.

[0033]When combination of barium was completed, it evaporated to dryness, and calcinated on the conditions of 600 **x 2 hours after desiccation of 110 **x 2 hours, and the catalyst was adjusted. The catalyst with result, platinum 2g, and barium 0.2mol and the presentation of 120 g of alumina (aluminum$_2O_3$) was acquired.

[0034]Gas occlusion is made to perform until it makes the mixed gas which contained NO_X using this catalyst contact and is saturated, The occlusion of NO_X and the check of discharge were performed by measuring the wave number of the NO_3^- peak of FT-IR, and the occlusion amount measured the amount of discharge NO_X in TG-DTA, and made it the NO_X occlusion amount. This method is the same as that of the following. They were the NO_X occlusion amount 24.7 (mg/g) at this time, and 19.9% of a barium capacity factor. The mixed gas said here has the presentation of NO 1000ppm, $O_2$5%, and N_2 balance. A barium capacity factor is a thing [as opposed to / a thing / a theoretical occlusion amount] of the rate of a survey occlusion amount.

[0035]A 2nd embodiment: First 41.2844 g of dinitrodiammine platinum (platinum concentration 4.578%), Dissolution mixing of 1.108 g of nitric acid rhodium (10.00% of rhodium concentration) and the polyacrylic acid 8g of the molecular weight 32400 was carried out at 2000 ml of water, 500 ml of ethanol was added, and it returned for 7 hours. This was condensed by suction filtration and polymers chelate catalyst metallic colloid was obtained as the polyacrylic acid-platinum / rhodium composite metal colloid of 1.195-% of the weight platinum and 0.069-% of the weight rhodium.

[0036]Next, the polyacrylic acid-platinum / rhodium composite metal colloid 16.74g of the alumina 12g used as a carrier, and the above-mentioned 1.195-% of the weight platinum and 0.069-% of the weight rhodium were added into 80 ml of water as a B process, it agitated for 30 minutes, and platinum-rhodium support was performed. The solution in which 40 ml of water was made to dissolve the barium acetate 5.11g was added as an A process, it agitated for 16 hours, and barium was combined.

[0037]When combination of barium was completed, it evaporated to dryness with the rotary evaporator, and calcinated on the conditions of 600 **x 2 hours after desiccation of 110 **x 2 hours, and the catalyst was adjusted. a result -- the platinum 1.8g and rhodium -- it became a catalyst with 0.2 g, barium 0.2mol, and the presentation of 120 g of alumina (aluminum$_2O_3$).

[0038]When the mixed gas which contained NO_X using this catalyst is made to contact and NO_X occlusion was made to perform, they were the NO_X occlusion amount 30.2 (mg/g) and 26.5% of a barium capacity factor. The statement which overlapped since it was the same as a 1st embodiment is abbreviated to the mixed gas and the barium capacity factor which are said here.

[0039]A 3rd embodiment: First 41.2844 g of dinitrodiammine platinum (platinum concentration 4.578%), Dissolution mixing of 1.108 g of nitric acid rhodium (10.00% of rhodium concentration) and 8 g of the polyallylamine of the molecular weight 50000 was carried out at 2000 ml of water, 500 ml of ethanol was added, and it returned for 7 hours. Suction filtration of this was carried out, it was condensed, and the polyallylamine platinum / rhodium composite metal colloid of 1.195-% of the weight platinum and 0.069-% of the weight rhodium were obtained as polymers chelate catalyst metallic colloid.

[0040]As an A process, the support to a carrier added the solution in which 40 ml of water was made to dissolve the EDTA barium 6g to the alumina 12g used as a carrier, and after making the beginning carry out churning adsorption for 1 hour, it evaporated to dryness to it, and dried on the conditions of 110 **x 2 hours to it, and it calcinated it on the conditions of 600 **x 2 hours to it. Then, what added the polyallylamine platinum / rhodium colloid 16.74g of the above-mentioned 1.195-% of the weight platinum and 0.069-% of the weight rhodium into 80 ml of water was added to the carrier after calcination as a B process, it agitated for 30 minutes, and platinum-rhodium support was performed.

[0041]When support was completed, it evaporated to dryness with the rotary evaporator, and calcinated on the conditions of 450 **x 2 hours after desiccation of 110 **x 2 hours, and the catalyst was adjusted. a result -- the platinum 1.8g and rhodium -- it became a catalyst with 0.2 g, barium 0.2mol, and the presentation of 120 g of alumina (aluminum$_2O_3$).

[0042]When the mixed gas which contained NO_X using this catalyst is made to contact and NO_X occlusion was made to perform, they were the NO_X occlusion amount 30.0 (mg/g) and 25.0% of a barium capacity factor. The statement which overlapped since it was the same as a 1st embodiment is abbreviated to the mixed gas and the barium capacity factor which are said here.

[0043]Comparison sample 1: Here, as a comparison sample with a 1st above-mentioned embodiment, dissolution mixing of 8.688 g of the dinitrodiammine platinum (platinum concentration 4.604%) was carried out at 450 ml of water, the alumina 12.0g used as a carrier was added, it agitated for 30 minutes and adsorption support was carried out. And this was separated and rinsed, it calcinated on the conditions of 450 **x 2 hours after desiccation of 110 **x 2 hours, and the platinum-alumina catalyst was adjusted.

[0044]Next, what dissolved 1.7g barium acetate in 20 ml of water was added to 9.15 g of this platinum-alumina catalyst, it agitated to it for 16 hours, and barium was combined with it.

[0045]When combination of barium was completed, it evaporated to dryness with the rotary evaporator, and calcinated on the conditions of 600 **x 2 hours after desiccation of 110 **x 2

hours, and the catalyst was adjusted. The catalyst with result, platinum 2g, and barium 0.2mol and the presentation of 120 g of alumina (aluminum$_2O_3$) was acquired. This was made into the comparison sample 1.

[0046]When the mixed gas which contained NO_X using this comparison sample 1 is made to contact and NO_X occlusion was made to perform, they were the NO_X occlusion amount 18.5 (mg/g) and 14.9% of a barium capacity factor. The statement which overlapped since it was the same as a 1st embodiment is abbreviated to the mixed gas said here.

[0047]Comparison sample 2: Further as a comparison sample with a 2nd embodiment and a 3rd embodiment, 41.2844 g of dinitrodiammine platinum (platinum concentration 4.578%), and 1.108 g of nitric acid rhodium (10.00% of rhodium concentration), Dissolution mixing of 8 g of the polyvinyl pyrrolidones of the molecular weight 25000 was carried out, the alumina 12g which is a carrier was added, and it agitated for 30 minutes, and calcinated after adsorption support for 450 **x 2 hours.

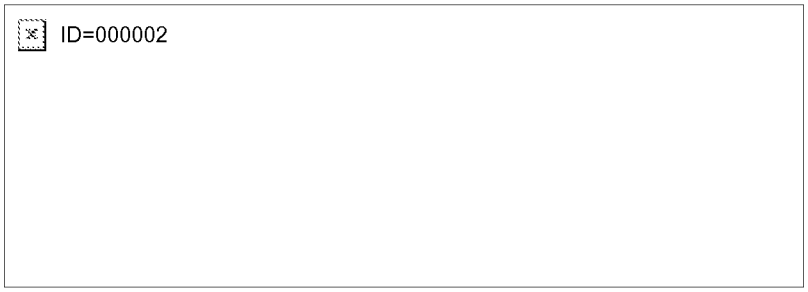
[0048]The barium acetate 5.11g was added after calcination, it agitated for 16 hours, and barium was combined. When combination of barium was completed, it evaporated to dryness with the rotary evaporator, and calcinated on the conditions of 600 **x 2 hours after desiccation of 110 **x 2 hours, and the catalyst was adjusted. a result -- the platinum 1.8g and rhodium -- the catalyst with 0.2 g, barium 0.2mol, and the presentation of 120 g of alumina (aluminum$_2O_3$) was acquired. This was made into the comparison sample 2.

[0049]When the mixed gas which contained NO_X using this comparison sample 2 is made to contact and NO_X occlusion was made to perform, they were the NO_X occlusion amount 27.7 (mg/g) and 22.4% of a barium capacity factor. The statement which overlapped since it was the same as a 1st embodiment is abbreviated to the mixed gas and the barium capacity factor which are said here.

[0050]To Table 1, the performance of the catalyst acquired by a 1st embodiment and the performance of the catalyst made into the comparison sample 1 were compared and published. In Table 2, the performance of the catalyst acquired by 2nd embodiment and a 3rd embodiment and the performance of the catalyst made into the comparison sample 2 were compared and published.

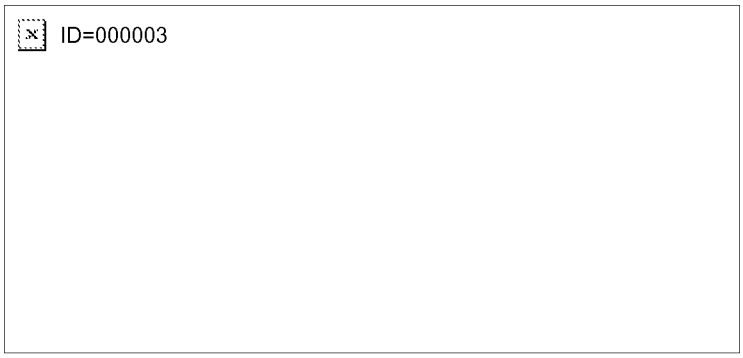
[0051]

[Table 1]



[0052]

[Table 2]



[0053]As shown in Table 1 and 2, even when the catalyst using single metal colloid which is a 1st embodiment is compared with the catalyst equivalent to the comparison sample 1, Even when the catalyst using composite metal colloid which is a 2nd embodiment and a 3rd embodiment is compared with the catalyst equivalent to the comparison sample 2, NO_X occlusion amount and the barium capacity factor of the catalyst which are applied to this invention in any case serve as a dramatically outstanding value.

[0054]

[Effect of the Invention]By using polymers chelate metal catalyst colloid concerning this invention, the degree of dispersion of alkaline metals is high, and supply of a catalyst with the catalyst performance which does not have degradation of catalyst performance and was excellent also under hot environments is enabled. If the exhaust gas cleaning catalyst of a car is manufactured using this polymers chelate metal catalyst colloid, the stable occlusion of NO_X which was not able to be obtained with the conventional catalyst will become possible, and it will become realizable [the low emission beagle using an internal-combustion engine].

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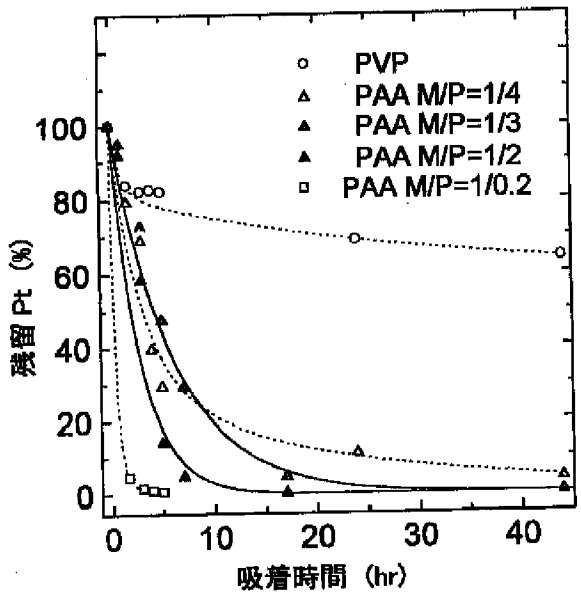
DRAWINGS

[Drawing 1]



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